

CHAPTER 6
MINERAL DUST - IMPINGER METHOD

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Chapter 6

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I. Introduction

In the past, inspectors collected midjet impinger samples and the analysis was performed by laboratory technicians located in each Metal and Nonmetal District. These functions have now been transferred to MSHA Technical Support. When impinger sampling is necessary (see discussion below), contact Technical Support to arrange for equipment and personnel. Because the sampling will be used for enforcement, an inspector must accompany Technical Support personnel and participate in the on-site sampling activities.

A. Contaminants Sampled Using Impingers

There are six silicates¹ sampled by the impinger method for determining personal exposures and subsequent compliance. Their TLVs[®] are expressed only in **mppcf units (million particles per cubic foot)**.

<u>Silicates (<1% quartz)</u>	<u>TLV[®] (mppcf)</u>
Mica	20
Perlite	30
Soapstone	20
Talc (non-asbestiform)	20
Graphite (natural)	15
Amorphous Silica and Natural Diatomaceous Earth	20

¹As listed on page 33 in the *TLVs[®] Threshold Limit Values for Chemical Substances in Workroom Air Adopted by the ACGIH for 1973*.

B. Gravimetric Screening and Exposure Sampling

Before considering the impinger sampling method, conduct full-shift screening sampling (personal respirable dust sampling) for the silicates listed above. Follow the guidelines in Chapter 5 of this Handbook for respirable dust sampling.

If a respirable sample exceeds the equivalent TLV[®] listed in Figure 6-1 and contains less than one percent (1%) free silica, it cannot be used for compliance. Follow-up sampling is required using the impinger method to determine compliance. If a respirable sample exceeds the equivalent TLV[®] and contains more than one percent (1%) silica, cite for non-compliance with the silica TLV[®]. **Use contaminant code 523 for all samples with > 1% silica.** When compliance with the silica TLV[®] has been achieved, re-screen for the listed substance. If the exposure is still over the equivalent TLV[®], conduct impinger sampling for compliance determination.

Substance	Impinger Limit (mppcf)	Equivalent TLV [®] (mg/m ³)	Contaminant Code
Mica	20	3.0	513
Perlite	30	8.6	515
Talc (non-asbestiform) and Soapstone	20	3.3	511
Graphite (natural)	15	1.9	517
Amorphous Silica and Natural Diatomaceous Earth	20	1.5	519

Figure 6-1. Gravimetric/Impinger Equivalent TLVs[®]

II. Impinger Sampling Equipment

A. Description of Impinger

Air is drawn through the impinger (refer to Figure 6-2) using a sampling pump at a recommended rate of 2.8 Lpm. The air sample is drawn through a one



Figure 6 -2. Impinger Assembly

millimeter (1mm) bore nozzle located five millimeters (5mm) from the bottom of the flask. The dust particles in the air are collected in the flask and retained in the liquid. Note: The impinger may be glass, so appropriate precautions should be taken when handling or shipping to the MSHA Laboratory.

B. Number and Duration of Samples

For an 8-hour shift, a minimum of nine impingers (eight exposure samples and one blank) are generally used for each miner sampled. Shifts longer than 8 hours require more impingers. Use an average of one impinger sample per hour. Impingers should be replaced in the impinger case immediately after sampling.

C. Collection Liquids

Depending on the contaminant sampled, the impinger collection liquids may be alcohol, distilled water, a combination of the two, or a special liquid for a particular problem. The most common collection liquid for mineral dust is reagent grade isopropyl alcohol.

D. Sampling Pump

Any pump can be used that can maintain a flow rate of 2.8 Lpm. The pump should be used with a trap to prevent the liquid from being drawn into the pump.

E. Nozzle Calibration Check

The calibration of all impinger nozzles must be checked using the configuration diagrams in Figure 6-3. The impinger nozzle calibration is checked using a sampling pump calibrated to a flow rate of 2.8 Lpm with a vacuum gauge or water manometer in line. If a differential pressure of 12.0 inches of water cannot be maintained, discard the nozzle.

F. Damaged or Defective Nozzle

If it is suspected that a nozzle is defective or damaged, discard it. If a damaged nozzle is found during or after sampling, void the sample.

G. Sampling Pump Calibration

When using a midjet impinger (with a nozzle whose calibration has been checked), calibrate the sampling pump to 2.8 Lpm, in accordance with Chapter 4 of this Handbook.

III. Impinger Sampling Procedures**A. Assignment of Unique Identification Number**

Record the number(s) in the Health Field Notes. If the impinger does not have a number, assign one and record it.

B. Prepare Blank Impinger

Prepare a blank impinger for each group of impinger samples representing a miner's full-shift exposure.

1. Prepare the blank impinger in the work area being sampled by first removing the side arm cap and then the nozzle cap. The "Z" guard and sampling tubing should be installed and removed before replacing the caps. This will represent all possible contamination sources from sample handling without pulling air through the impinger.
2. Do not connect the blank impinger to the sampling pump hose.

3. Mark the blank to identify whose exposure it affects and to identify it as a blank sample. Record the blank sample information in the Health Field Notes.

C. Prepare the Sampling Pump and Impinger

Approximately one meter (or three feet) of tubing is needed to connect the sampling pump and impinger. The tubing must reach from the belt of the collector (who wears the pump) to the end of the collector's arm, so the impinger can be held in the breathing zone of the miner with minimal interference from the collector. Tygon tubing is recommended because it is clear, making any potential sample loss more evident, but rubber tubing may also be used.

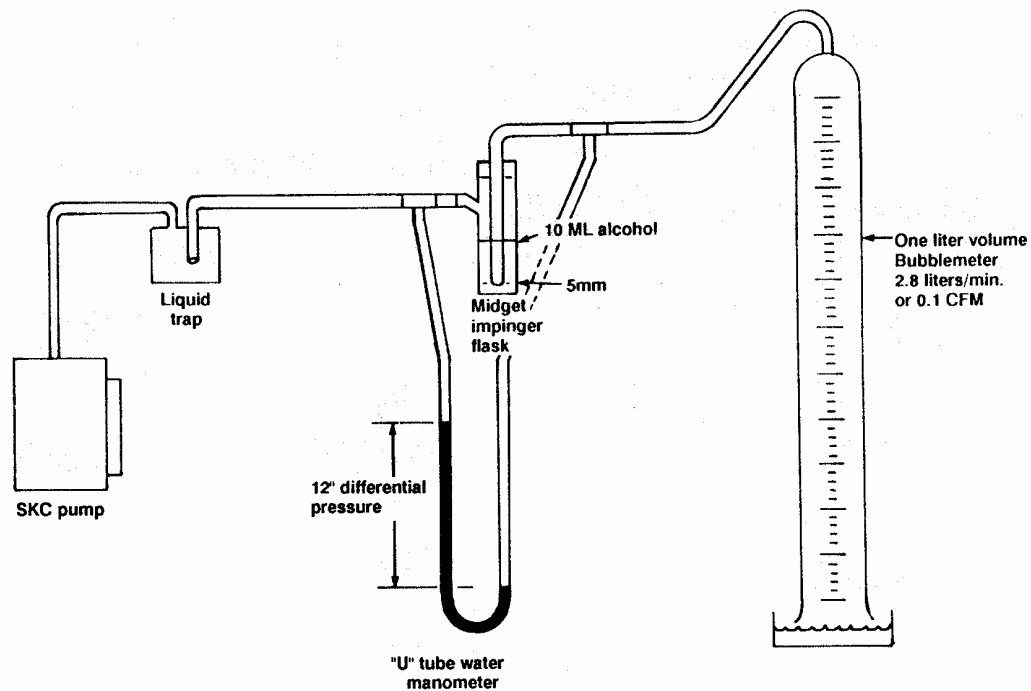


Figure 6-3. Impinger Nozzle Calibration Check Setup

D. Instructions to Miner

Inform the miner about the following:

1. Emphasize the need for the miner to continue to work in a routine manner and to indicate to you any unusual occurrence during the sample period.
2. Explain to the miner what you are doing, what the sampling device does, and the reason for sampling.

E. Collect the Sample

1. Check the impinger to verify:
 - The number of the impinger used;
 - That the level of collection liquid is at the expected level (slightly above the 10 mL mark and not below 5 mL during sampling); and
 - The nozzle is set at the 5 mm line.
2. Remove the side arm cap first, then the nozzle cap. Place the caps in a plastic bag or a dust-free envelope.
3. Connect the side arm of the impinger to the tubing connected to the pump.
4. Start the sampling pump and begin timing (record time).
5. Wear the pump on your own belt for impinger sampling.
6. Hold the impinger near the miner's breathing zone for the duration of the sample. Do not require the miner to wear the impinger.
7. Sample for about 10 minutes. Sampling periods may range between 5 and 15 minutes. The exact sampling period must be recorded in the Health Field Notes.
8. At the end of the sampling time, stop the pump and record the time.

9. Remove the tubing from the impinger (keep the open end of the tubing in your pocket to avoid dust exposure). Replace the nozzle cap first, then replace the side arm cap.
10. Write the time period of the sample on the impinger label and place the impinger in the carrying block. Record the miner's activities and sources of exposure in the Health Field Notes.
11. Repeat steps 1 through 10 for each impinger until sufficient samples are collected to determine representative exposures for the miner.

F. Record Information

Throughout the shift record the following pertinent information in the Health Field Notes (refer to Chapter 21, Section V):

- The number of each impinger used and the corresponding sampling times;
- Miner's name, job title, and work location(s);
- Shift hours per day and days per week worked;
- Activity of miner, equipment operating in the area, and approximate time spent at each activity;
- Controls in use, a general description of the controls, and whether or not they seem adequate;
- Potential sources of exposure, a general description of these sources, whether they are routine sources or occasional sources, and suggested possible additional controls;
- Any other samples taken and results, if available (*e.g.*, noise, detector tubes, etc.);
- Any respirator worn (brand, model, type of filters);
- Whether an acceptable respiratory protection program exists (see Chapter 16 for criteria for evaluating respiratory protection program); and
- Environmental conditions (such as wind, temperature, and humidity).

G. Transport

After collecting the samples and one blank, securely place impingers in a container to prevent leakage, breakage, and jostling. The samples must be analyzed within 24 hours of collection. To achieve this, Technical Support may need to analyze the results at field locations.

IV. Post-Inspection Procedures**A. Review Health Field Notes**

Check that you have recorded all the necessary information in the Health Field Notes.

B. Post-Calibration of Sampling Pump

Check sampling pump calibration in accordance with Chapter 4 of this Handbook.

C. Submit Samples for Analysis

Coordinate with Technical Support to ensure that the analysis is conducted within the 24-hour period.

D. Compliance Determination

- 1. Calculations.** Particle counting is performed by Technical Support and is referenced to each impinger. All impingers used to sample the full-shift exposure of a miner are counted and each count is time weighted for that segment of the shift that it represents. The sum of these counts becomes the shift-weighted average (SWA) count for that miner. See Chapter 2 of this Handbook for calculations and procedures.
- 2. Error Factor.** The error factor for impinger sampling will be supplied by Technical Support.

E. Report Writing

1. Report **gravimetric screening** on the Personal Exposure Data Summary (PEDS - refer to Chapter 21, Section VIII). When the **impinger sampling** results are received from Technical Support, complete another PEDS.
2. Submit a copy of the Health Field Notes, the sampling results, citations or orders (if applicable), and the PEDS with the inspection report.